Keenleyside powerplant project
land use study

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This impact assessment is based on the "Keenleyside Powerplant Project Engineering Description" prepared in November 1982. Since that time, ongoing planning and design studies have resulted in some changes that would affect the project description. The principal changes are as follows:

- In-service date has changed from 1992 to 1994 and the optional in-service date of 1990 is no longer being considered.

- Installed capacity has changed from 210 MW to 180 MW with corresponding changes to powerhouse design.

The above changes have been incorporated in the report only where they would affect the results of the impact assessment.

KEENLEYSIDE POWERPLANT PROJECT
LAND USE STUDY
FINAL REPORT

May, 1982
Revised March, 1984

KEENLEYSIDE POWERPLANT PROJECT
LAND USE STUDY

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SUMMARY

The land use study focussed primarily on those aspects of the study area environment pertaining to the use of land for human settlement, including residential, recreational, institutional, industrial and commercial uses. There were three primary objectives to the land use component of the study:

1) Prepare a land use inventory map for that part of the study area bordering Lower Arrow Lake to be included in the Keenleyside Powerplant Project Environmental Impact Assessment Resource Atlas.
2) Prepare a status report on the current state of land use planning in the study area.
3) Assess the direct and indirect impacts of the project on existing, planned or proposed land uses and existing planning policies, and determine whether existing land use planning policies are adequate to accommodate conditions brought about by the Keenleyside Powerplant Project.

The conditions associated with the Keenleyside Powerplant Project which would have a permanent or long term impact on the study area from a land use perspective were identified as:

i) the powerplant and associated structures
ii) realignment of the Robson-Broadwater Highway
iii) permanent employee housing
iv) changes in topography as a result of excavation and placement of material used in the construction of the powerplant

Conditions of a more temporary or short term nature are:

i) temporary employee housing; in the form of a construction camp and in-town housing
ii) associated construction camp impacts
iii) intermittent closure of Robson-Broadwater Highway
iv) increased auto and truck traffic.

The study area extends 10 km upstream and downstream of the Hugh Keenleyside Dam to an elevation of 500 m. It includes the rural communities of Balfour subdivision, Robson, Raspberry and Brilliant, and part of the municipality of Castlegar. The rural communities are basically residential settlements with little or no commercial or industrial uses. Castlegar functions as the major employment, transportation, retailing and service centre for the area. The portion of the study area along the Lower Arrow Lake is largely undeveloped, consisting primarily of crown land, parks, vacant private land, marinas, and small clusters of residential development, with Syringa Creek Provincial Park being a dominant land use feature.

Local and regional government administration is provided by three forms of government - City municipalities (Castlegar), Regional District (Central Kootenay) and Improvement Districts (provide water to most rural communities). Planning and land use management activities are carried out by the City of Castlegar for Castlegar, the Regional District of Central Kootenay for the rural communities and surrounding area, and the Ministry of Lands, Parks and Housing for Crown land. The City of Castlegar has adopted an Official Community Plan, and the Regional District of Central Kootenay has recently adopted the Lower Arrow Lake Regional Plan and the Castlegar Fringe Settlement Plan. Through the planning activities of these agencies, areas to accommodate future demands for various forms of development have been identified. There

is an ample supply of land within the study area to accommodate well in excess of projected demands for all forms of development in the foreseeable future. A common feature of all future development areas, however, is that major capital expenditures on services such as water, sewer and access roads would be required before development could take place.

The conditions associated with the Keenleyside Powerplant Project which would have a significant impact from a land use perspective are temporary or short term in duration. None of the permanent or long term conditions will have a significant impact on existing, planned or proposed land uses. Of the temporary or short term conditions, only two will have any significant impact on the study area - temporary employee housing, and increased auto and heavy truck traffic volumes and possible associated safety hazards, particularly on Robson-Broadwater Highway. It is estimated that there would be a maximum incremental demand for approximately 30 housing units by the Keenleyside temporary employees (DPA, 1983). The second impact would be increased traffic volumes along Robson-Broadwater highway and increased ferry patronage. The increased traffic volumes may result in conflicts with residents along the highway who will have to cross the project-related traffic flow during rush hours to gain access to their residences. The potential for increased safety hazards for bicyclists and pedestrians also exists. Increased ferry patronage may result in waits on either ends of the crossing.

The overall incremental impact of the Keenleyside Powerplant Project on the Murphy Creek Project will be slight. The major incremental impact will be in terms of the demand for additional employee housing. The Keenleyside Powerplant Project will result in a maximum incremental demand of approximately 30 units by temporary employees, and 6 units by permanent employees.

The actual housing demand for the Keenleyside-Murphy Project would vary depending upon a number of variables, including:

- the in-service date chosen
- the number of temporary employees who can shift from one project to the other
- whether or not protective works are installed
- the time frame of the housing demand by temporary and permanent employees and displaced households.

Assuming the housing market conditions found in 1982 continue (a 10% rental accommodation vacancy rate[3]), and assuming protective works are installed, the incremental housing demand from the Keenleyside Powerplant Project should be readily absorbed by the existing housing market, in combination with infilling in existing development areas.

In order to mitigate any adverse impacts associated with the project, a number of recommendations have been made. These are in addition to those made in the Murphy Creek Project General Land Use Study. The additional recommendations are:

i) provide for appropriate reclamation of all borrow pits.
ii) schedule construction activity to minimize closure of the Robson-Broadwater Highway during highway realignment.
iii) provide a haul road so that heavy truck traffic from the borrow pits along Lower Arrow Lake would not restrict access to properties and public facilities along the reservoir.

SUMMARY (cont'd)

iv) design the construction camp to minimize potential noise conflicts with surrounding land uses. Provision of a buffer surrounding the camp is one possible solution.

v) instigate programmes and strategies designed to reduce traffic volumes along Robson-Broadwater Highway. Suggestions include: car pooling, staggered working hours, and parking lots at the south end of dam.

vi) undertake a detailed transportation analysis, taking into consideration the existing condition and function of Robson-Broadwater Highway, existing traffic volumes, and projected increases in traffic-type and volume of vehicles. The analysis would also examine the impact of increased traffic volumes on the Robson-Castlegar ferry service, and necessary mitigation measures.

1.1 Role of Land Use Discipline

In relation to the overall environmental impact assessment of the Keenleyside Powerplant Project, the land use discipline focussed primarily on those aspects of the study area environment pertaining to the use of land for human settlement, including residential, recreational, institutional, industrial, and commercial uses. Aspects of human settlement and land uses taken into consideration included existing land use patterns, planned and potential users, land use status, land use planning, and impacts on the transportation network.

1.2 Study Objectives

There were three principal objectives for the land use component of the overall study. The first was to prepare a land use inventory map of that part of the study area above the Hugh Keenleyside Dam, noting in particular the present, planned and potential land uses. This inventory map was then incorporated into the Keenleyside Powerplant Project Environmental Impact Assessment Resource Atlas. The second principal objective was to provide an updated status report on the current state of land use planning in the study area, primarily from the point of view of the City of Castlegar and the Regional District of Central Kootenay. The final objective was an assessment of the project, from the point of view of:

1.2 Study Objectives (cont'd)

1) direct and indirect impact on present uses of land,

2) direct and indirect impact on potential and planned uses of land, and subsequent impact on the land use planning activities and policies of the city and regional district, and

3) the adequacy of existing land use planning policies and implementation bylaws to accommodate conditions brought about by the Keenleyside Powerplant Project. If required, an outline of planning activities to be completed to accommodate any changed conditions was to be included.

There were a number of basic assumptions attached to these objectives. The study assumes that the Murphy Creek Project will go ahead, with a reservoir level elevation of 424 metres. The impacts noted in this study are therefore to be considered incremental to the Murphy Creek Project.

This report is intended to be read in conjunction with the Murphy Creek Project Land Use Study, and is written as a supplement to that report.

1.3 Potential Impacts

The conditions associated with the Keenleyside Powerplant Project which will have a permanent or long term impact on the study area from a land use perspective are:

i) the powerplant and associated structures
ii) realignment of the Robson-Broadwater Highway
iii) permanent employee housing
iv) increased traffic to and from dam
v) changes in topography as a result of excavation and placement of materials used in the construction of the generating plant.

1.3 Potential Impacts (cont'd)

Conditions of a more temporary or short term nature are:

i) temporary employee housing in the form of a construction camp and in-town housing
ii) associated construction camp impacts
iii) intermittent closure of Robson-Broadwater Highway
iv) increased auto and truck traffic volumes

1.4 Study Personnel

The project coordinator for the land use study was Gordon Petersen, M.C.I.P., Senior Planner for the consulting firm Urban Systems Ltd. The project planner was Robert Goldie, M.C.I.P., Community Planner for Urban Systems Ltd.

STUDY AREA OVERVIEW SECTION 2

The following overview provides a general discussion of present, planned and potential land uses in the study area, local government structure and current local and regional planning activities. The study area extends 10 km upstream and downstream of the Hugh Keenleyside dam, to an elevation of 500 metres a.s.l. The study area includes the municipality of Castlegar, and the rural communities of Balfour subdivision, Robson, Raspberry and Brilliant. In terms of existing features and development potential, the study area divides quite easily into three subsections, with the Hugh Keenleyside dam and the Columbia River downstream being the dividing lines. The area west of the dam along Lower Arrow Lake is largely undeveloped and generally recreation-oriented, with limited access. Downstream from the dam, the Columbia River separates the City of Castlegar from the rural communities of Balfour subdivision, Robson, Raspberry and Brilliant.

2.1 Existing and Proposed Land Uses

2.1.1 Castlegar

As illustrated in the Resource Atlas, the City of Castlegar extends along the south and west banks of the Columbia River, from just west of the Hugh Keenleyside dam, to the communities of Blueberry Creek and Fairview. The city dominates the area, functioning as the major employment, transportation, retailing, and service centre for the rural communities surrounding the city, and the sub-region beyond.

The dominant land use between the dam and the ferry connecting Robson to Castlegar is the B. C. Timber Ltd. pulp and paper mill, and saw mill. The land surrounding the mill is zoned heavy industrial and remains vacant at this time. B. C. Timber Ltd. has plans for an expansion of both the sawmill and pulp and paper mill. There appear to be no other known proposed developments for this area.

The remaining portion of Castlegar within the study area consists of the central business district, the railroad yard, and surrounding older residential neighbourhoods. The land is developed, with the potential for redevelopment in some locations.

There are a number of transportation linkages between Castlegar and the surrounding communities. A road extends along the south bank of the Columbia River, servicing the industrial area, before crossing the dam and connecting with the Robson-Broadwater Highway. There is also a ferry which operates between Robson and north Castlegar. The third vehicle access point is a bridge connecting south Castlegar with Ooteschenia.

There are three railroad lines entering Castlegar; one from Trail to the south, one from the Kootenay River valley through Brilliant and Raspberry, before crossing the river to north Castlegar, and the third extends from the Arrow Lakes Reservoir area along the south bank of the Columbia River into north Castlegar.

2.1 Existing and Proposed Land Uses (cont'd)

2.1.2 Rural Communities

The communities of Balfour subdivision, Robson, East and West Raspberry, and Brilliant abut one another in a long strip along the north bank of the Columbia River from the dam to the Kootenay River. The communities are almost exclusively rural residential, being interspersed with orchards, vacant land, and other agricultural uses. The area is slowly being subdivided and becoming more urbanized.

Another important land use in the area is Pass Creek Regional park, located in a low-lying area between West and East Raspberry. Although existing improvements in the park are limited, long range plans prepared by the Regional District of Central Kootenay envisage the development of a major regional park.[9] The park would be partially inundated by the Murphy Creek reservoir.

The only major road through the area is the Robson-Broadwater highway, which extends from Highway 3A in Brilliant through the communities and beyond the dam to Syringa Creek Provincial Park. At present the road provides the only access to the rural communities and the recreation areas beyond the dam. Access across to Castlegar is achieved by the three routes noted earlier: the Robson ferry, the road across the dam, and the bridge at the south end of Castlegar.

2.1.3 Rural Areas

The area west of the dam along Lower Arrow Lake is largely undeveloped, consisting primarily of crown land, parks, vacant private land, marinas, and small clusters of residential development. The dominant land use in the area is the Syringa Creek Provincial Park, located approximately 7 km west of the dam on the north shore. The park is very popular and functions as the region's primary recreation area.

2.1 Existing and Proposed Land Uses (cont'd)

2.1.3 Rural Areas (cont'd)

The only road access to Lower Arrow Lake is the Robson-Broadwater Highway which runs along the north shore to Syringa Creek Provincial Park. The road branches at the park and continues as a narrow gravel road along the reservoir. The CP railroad extends through the area along the south shore.

There are at present only two small residential subdivisions in the area; one consisting of 5 homes beside Allandale Creek, and the other consisting of 3 homes adjacent to the eastern boundary of Syringa Creek Provincial Park. In addition, there are several seasonal cabins on the south bank of Lower Arrow Lake, at the mouth of Moberley Creek, as well as several houseboats near Tulip Creek. There are three marinas located along the north shore of the reservoir. Two are located at Syringa Creek Provincial Park, and the other halfway between the park and dam.

2.2 Local and Regional Government Structures

2.2.1 Regional Districts

The entire study area falls within the boundaries of the Regional District of Central Kootenay, based in Nelson. The Regional District has been very active in providing planning services to all unincorporated areas within the study area including the rural communities of Balfour subdivision, Robson, Brilliant, East and West Raspberry, and the rural area west of the dam. Regional Districts have jurisdiction over the control of land use and management of new development in unincorporated areas, primarily by four devices - an Official Regional Plan, Official Settlement Plans, Zoning Bylaws, and Subdivision Control Bylaws. In unincorporated areas, however, the final authority for approval of subdivisions is the Ministry of Transportation and Highways. Regional Districts as a general rule do not get involved in the provision and financing of infrastructure services to the same extent as municipalities. Roads are the responsibility of the Ministry of Transportation and Highways, and the provision of services such as water is generally carried out by Improvement Districts in the unincorporated settlements in the area.[10] The Ministry of Lands, Parks and Housing plays a major role in the planning of land uses on Crown land. Crown Land Management Plans are the principal method used by the Ministry to manage Crown lands. There are no Crown Land Management Plans in the study area. The Ministry of Lands, Parks and Housing also issues foreshore leases along Lower Arrow Lake and the Columbia River. These leases are often used for log dumping and storage, and for recreational development.

2.2 Local and Regional Government Structures

2.2.2 Municipalities

The only incorporated municipality in the study area is the City of Castlegar. Municipalities have jurisdiction over the control of land use and management of new development within municipal boundaries, primarily by means of three devices - the Official Community Plan, the Zoning Bylaw, and the Subdivision Control Bylaw. Municipalities also are responsible for the delivery and financing of a wide variety of municipal services, including transportation and roads, water, sewer, drainage, fire protection, police protection, recreation and general government.[10]

2.2.3 Improvement Districts

Improvement Districts have been established at Robson, West Raspberry, and Brilliant. Balfour has its own water system but is not officially considered an improvement district. Improvement districts are distinct from municipalities and regional districts in that they have no jurisdiction over planning and land use control. Their sole function is to provide basic services to property, water being the most common.[10]

2.3 Local and Regional Land Use Planning Activities

This section consists of a summary of the planning activities being carried out by the Regional District and the City of Castlegar, along with a brief overview of the contents of relevant planning documents with respect to the capability of the settlements to accommodate new development, taking into consideration the availability of land, servicing requirements, and planning policies. A number of Provincial Government agencies also have an involvement in the planning activities being carried out in the area, primarily by means of participation with the Regional District in the preparation of Official Regional Plans and Official Settlement Plans. These agencies include among others, the Ministry of Municipal Affairs, the Ministry of Transportation and Highways, the Ministry of Lands, Parks, and Housing, the Ministry of Environment, the Ministry of Health, the Ministry of Agriculture and the B.C. Agricultural Land Commission.

2.3.1 City of Castlegar

The City of Castlegar adopted an Official Community Plan in 1981. The plan contains a number of policies which outline the accommodation of future demands for new residential, commercial, industrial and public use development. According to the Community Plan, there is an ample supply of land to accommodate anticipated demands for all forms of new development in the foreseeable future. Although there is some room for infilling in existing development areas (multi-family residential development and general commercial development), most new lower density residential development and industrial development will be located on vacant lands in new development areas. New residential development areas will generally be located on benchlands to the west of existing development areas, and an industrial development area has been designated for the area in the south sector of Castlegar near Blueberry. Because these are new development areas, large capital expenditures to bring major trunk services (e.g. water, sewer, roads) will be required in order to accommodate new development.[11]

2.3 Local and Regional Land Use Planning Activities

2.3.2 Regional District of Central Kootenay

Rural Communities

In 1981, the Regional District completed the Lower Arrow Lake Regional Plan, and more recently completed the Castlegar Fringe Official Settlement Plan. Both documents identify Robson, Raspberry and Brilliant as primary settlement areas, which means they are recognized as priority areas for residential development within the settlement plan boundaries. Balfour is identified as a rural settlement area, meaning that the emphasis is on preserving and maintaining the existing level of community services, recognizing that growth may occur should the Robson sewer system be extended to Balfour, and the two water systems amalgamated.

According to the Lower Arrow Lake Regional Plan and the Castlegar Fringe Settlement Plan prepared by the Regional District of Central Kootenay, the rural communities will gradually become more intensely developed as necessary water and sewer services are provided. Due to the close proximity of the communities to Castlegar, it is doubtful that a separate commercial core will develop on the north bank. Other proposed changes to the existing land use pattern along the north bank involve improving the transportation linkages. The Regional District presently supports the concept of a second major service road along the north shore, just above the presently developed areas.[9] This road would provide better access to the area, thereby reducing dependency upon the Robson-Broadwater Highway. The Regional District also recommends a bridge crossing at the present location of the Robson-Castlegar ferry.

2.3 Local and Regional Land Use Planning Activities

2.3.2 Regional District of Central Kootenay (cont'd)

Rural Areas

There are a number of district lots along both sides of Lower Arrow Lake which are designated in the Lower Arrow Lake Regional Plan as Rural Resource Settlement Areas, meaning they have potential for some form of resource-oriented development. These areas are zoned "Rural", which allows residential and resource uses on 5 acre lots.[8] The land extending from just east of Syringa Creek Provincial Park to the dam has been designated a Recreation Development Area. Residential development clusters and recreation facilities are to be encouraged in this area. The planning concept is to allow 0.2 to 0.4 hectare lots for the residential sites, depending on a set of development criteria. The zoning bylaw will be amended to reflect this density sometime in the near future.

There are several potential park sites along the reservoir. Tulip Creek has been proposed by the Ministry of Lands, Parks and Housing as a provincial park site, and is presently reserved for the use and recreational enjoyment of the public. There is also another potential site about 1 km west of Tulip Creek, and another across the lake from Tulip Creek, referred to as the Boulder Creek Established Map Reserve.

In the Lower Arrow Lake Regional Plan, the Regional District foresees this area as being developed primarily for recreational uses, with rural residential and some compatible resource-oriented commercial and industrial uses being permitted. The Regional District presently recommends that the gravel road between Syringa Creek Provincial Park and the community of Deer Park north along the reservoir be upgraded and developed into a regional highway.[7] This would greatly increase the accessibility of the area and provide a better access route from Castlegar to these communities.

The conditions associated with the Keenleyside Powerplant Project which will have an impact on the study area from a land use perspective have been classified into two categories: those of a permanent or long term nature, and those of a temporary or short term nature.

3.1 Permanent or Long Term Conditions

The permanent or long term conditions associated with the Keenleyside Powerplant Project have been identified as:

i) the powerplant and associated structures
ii) Robson-Broadwater Highway realignment
iii) permanent employee housing
iv) increased work-associated vehicular traffic to and from the dam
v) changes in topography as a result of excavation and placement of materials used for construction of generating plant

3.1.1 Powerplant

The powerplant would be located at the north end of the dam, between the existing discharge facilities and the Robson-Broadwater Highway. Construction of the powerplant would require removal of over burden to expose the bedrock below in order to provide a solid foundation. There would also be two transformers located immediately downstream of the powerplant.[1]

There would be virtually no permanent land use impacts as a result of the powerplant and associated buildings. The plant and transformers are located on B.C. Hydro property, and would appear as an extension of the existing dam and should not create any perceivable land use impacts.

From a planning policy perspective, the powerplant should not require any changes to present policy. The land zoned for industrial use to the south of the dam would not be affected by the powerplant on a permanent basis, nor would the land zoned rural along the north shore. Land to the west of the dam on the north shore should have the same development potential with or without the generation facilities.

3.1 Permanent or Long Term Conditions (cont'd)

3.1.2 Robson-Broadwater Highway Realignment

The creation of the powerplant at the north end of the existing dam would require a realignment of the Robson-Broadwater highway. Approximately 1200 meters of this highway will be relocated slightly closer to the shoreline.[1] For exact locational information, please consult the Columbia River, Keenleyside Powerplant Project Engineering Description (November 1982). The land is owned by B.C. Hydro.

There should be no long term land use impacts due to the highway realignment. The highway would still continue to provide access, and the time difference between the present and future alignments would not be noticable. There should be no impact at all on local planning policy as the highway would still continue to function as the primary access route.

3.1.3 Permanent Employee Housing

According to the latest information from B.C. Hydro, the permanent new employee population is expected to be approximately 6 persons.[3] These people would be primarily technical staff responsible for operating the powerplant; all routine maintenance would be done by present employees at the dam. The staff is minimal because the powerplant will be remotely controlled through the B.C. Hydro Microwave System.

Assuming that each employee would require an additional housing unit, the total housing demand may be as high as 6 units. If, on the other hand, local residents are hired for these positions, there will be no additional demand. The range is therefore somewhere between 0 and 6 housing units.

3.1 Permanent or Long Term Conditions (cont'd)

3.1.3 Permanent Employee Housing (cont'd)

In terms of a land use impact, the demand for up to an additional 6 housing units would have little effect on the housing market. The demand for six units can be absorbed readily by the existing housing market without having to build any additional units.

As current land use planning policies provide for an adequate supply of land for future residential development in a range of housing types, there will be no need to modify the existing policies.

3.1.4 Increased Traffic Volumes

Traffic generated due to the powerplant once it is in operation would result in only a slight increase in traffic volumes. B.C. Hydro presently estimates the permanent workforce for the powerplant would be approximately 6 persons, working day shift. This would mean an increase in traffic volumes due to employees of up to 6 trips per rush hour. There would also be auto and truck traffic associated with bringing in supplies and materials necessary for routine operation and maintenance of the powerplant.

The land use impacts resulting from this increase in traffic volume would be virtually unnoticable due to the low number of trips involved. Since employees would have direct access to either the Robson-Broadwater Highway or Arrow Lake Drive via the connecting road across the dam, there should be no noticeable increase in traffic volumes on the ferry by permanent employees or service vehicles. There would be no need, therefore, to modify existing planning policies with regard to the transportation network.

3.1 Permanent or Long Term Conditions (cont'd)

3.1.5 Excavation and Placement of Materials

It is presently anticipated that construction of the powerplant would require approximately 160,000 m^3 of concrete, or approximately 340,000 tons of concrete aggregate materials. B.C. Hydro plans to utilize one of the borrow pits used for the original dam construction, located 1 to 2 km from the dam on the north shore of Lower Arrow Lake. Use of this pit will modify the terrain accordingly.[1] The pit is on land owned by B C Timber Ltd. B.C. Hydro plans to undertake a reclamation programme once excavation is completed.

The cofferdam construction would involve the placement of some 300,000 m^3 of rock and earthfill in the upstream and downstream cofferdams, plus the excavation and disposal of some 1.6 x $10^6 m^3$ (in situ) of silts, sands, gravels, and rock. B.C. Hydro presently plans on depositing these materials along the north shore of the Lower Arrow Lake reservoir, approximately 1 to 3 km upstream of the dam.[1] These pits, located on either B C Timber Ltd. or B.C. Hydro property, would also be included in the reclamation programme.

It is anticipated that up to 140,000 m^3 of glacial till borrow would be required for the cofferdams and to extend the impervious blanket in front of the dam. B.C. Hydro plans to use one of the borrow pits on the hillside above Balfour subdivision and Robson, for which they still hold a reserve.[1] Utilization of this site may increase the size of the pit, which is a visible scar on the hillside. B.C. Hydro presently plans to undertake a reclamation programme, which, in the long term, would serve to minimize the visual and topographic impact of the borrow pit.

For the exact location of each of these pits, please refer to Figure 6-2 of the Columbia River, Keenleyside Powerplant Project, Engineering Description (November, 1982).

3.1 Permanent or Long Term Conditions (cont'd)

3.1.5 Excavation and Placement of Materials (cont'd)

Apart from the cavity created, use of the pits would probably continue to affect the quality of water in the streams passing through the immediate area. These streams were once the water supply for homes in the Balfour subdivision, but when borrow pit operations began in 1965 for the construction of the Hugh Keenleyside dam, the operations interfered with several creeks. B.C. Hydro then constructed the present water system to serve the community until the water in the creeks was once more potable.[6] Reuse of the pits could lengthen the time period for which B.C. Hydro may need to continue to provide Balfour residents with water.

Assuming the programmes of reclamation of the borrow pit and restoration of the water quality in the creeks are successful, there would be no long term impacts resulting from the extraction of materials from the borrow pits.

There would be no long term impacts on local and regional planning policies. The borrow pit above Balfour subdivision and Robson is on Crown land and not considered in current local and regional planning policies. The borrow pits along Lower Arrow Lake, when reclamation is complete, would comply with the Regional Plan designation the area currently has of "Recreation Development Area". Recreation-oriented uses are encouraged in areas with this designation, with an emphasis on maintaining environmental quality and open space. Reclamation would ensure that the borrow pits do not detract from the area or reduce the utility of surrounding properties for recreation uses.

3.2 Temporary or Short Term Conditions

The temporary or short term conditions associated with the Keenleyside Powerplant Project having a potential impact on the study area from a land use perspective have been identified as follows:

i) temporary employee housing
ii) associated construction camp impacts
iii) associated construction site impacts
iv) increased traffic volumes and heavy truck traffic
v) intermittent closure of the Robson-Broadwater Highway

3.2.1 Temporary Employee Housing

According to the latest information from B.C. Hydro, there would be a peak labour force of approximately 540 employees.[1] B.C. Hydro is planning to build a construction camp able to accommodate up to 60% of the workforce, or approximately 320 people.[1]

At present, DPA Consulting Ltd. estimates that the local labour force will fill the majority of the jobs, ranging from 54% to 91% of the labour force. The maximum in-migrant labour force residing outside of the construction camp is estimated to be approximately 30.[3] These estimates result in a very low demand for additional housing units within the study area. Assuming 1 housing unit per construction worker, the maximum demand for new units would be 30 units.

According to D.P.A., there was a 10% vacancy rate in rental accommodation in the study area in 1982.[3] Assuming the housing market conditions found in 1982 continue to the end of the Keenleyside Powerplant Project construction period, the existing housing market, combined with some infill in existing developed areas, should readily accommodate the housing demand by temporary employee households. There is currently enough land reserved for future residential development in the study area to accommodate 2900 additional units. Even with the Murphy Creek Project, there is ample land available to meet all demands.

3.2 Temporary or Short Term Conditions (cont'd)

3.2.1 Temporary Employee Housing (cont'd)

From a planning policy perspective, this potential increase in demand for residential housing would not require changes to existing planning policies, as the Castlegar Official Community Plan and the Castlegar Fringe Settlement Plan have identified and set aside an adequate supply of land for residential purposes.

3.2.2 Associated Construction Camp Impacts

The offices and construction camp would be located on the north bank of the Columbia River, approximately 0.7 km downstream from the dam. The property is owned by B.C. Hydro and is the location of the construction camp for the original dam construction. The camp would be built to accommodate up to 60% of the peak work force, or approximately 320 people.[1]

There may be some conflicts associated with the close proximity of construction camp to the Balfour subdivision. The noise and activity associated with the camp may be disruptive to the lifestyles of local residents. The development of a vegetated buffer zone between the camp and potentially affected properties is one solution which should alleviate much of the impact.

The camp itself would generate a considerable amount of traffic which would have an impact on the residential areas along the Robson-Broadwater Highway. This traffic would not be confined to rush hours, as many camp residents would use the retail, social and recreation facilities in Castlegar during their spare time.

3.2 Temporary or Short Term Conditions (cont'd)

3.2.2 Associated Construction Camp Impacts (cont'd)

The current zoning designation for the site is "Rural", which permits public utility uses. It is the present interpretation of the Regional District that the construction camp is an accessory use to a public utility, and therefore a permitted use. In light of this, there is no need to amend existing planning policy.

3.2.3 Associated Construction Site Impacts

The actual construction activity would have little impact on surrounding properties, due to the north end of the dam being surrounded by vacant Crown Land or land owned by B.C. Hydro. The nearest land use along Lower Arrow Lake is a B C Timber log sorting site located just under 1 km from the dam. The impact of the dam construction on this use should be minimal. However, the sorting area is surrounded by B.C. Hydro land which will be used for spoil dumping. As such, the site would be affected due to the close proximity of heavy equipment. B.C. Hydro is considering purchasing or exchanging other land for this property. The next nearest land use along Lower Arrow Lake is a marina located approximately 4 km from the dam. The distance between should eliminate any potential impacts. Along the north bank of the Columbia River downstream from the dam, there is only one property within 1.5 km. This property would undoubtedly be affected by the construction activity (in terms of noise, dust and possibly vibration).

The construction activity itself would not require any modifications to existing planning policy, as the addition of the powerplant to the dam was anticipated in present planning policies.

3.2 Temporary or Short Term Conditions (cont'd)

3.2.4 Increased Traffic Volumes and Heavy Truck Traffic

The construction activity associated with the project would result in an increase in traffic volumes and in the number of heavy vehicles. This traffic can approach the dam along two routes: the Robson-Broadwater Highway and Arrow Lakes Drive. However, due to the location of the work site, construction camp and parking lots on the north end of the dam, the traffic would probably be concentrated on the Robson-Broadwater Highway. This traffic increase can be identified as follows:

i) workers from off-site housing commuting to construction site
ii) construction camp workers driving to work or into Castlegar
iii) supply vehicles for the construction site; light and heavy trucks

This traffic increase could create conflicts with residents along the Robson-Broadwater Highway. The highway presently provides the only access to the communities of Balfour subdivision and Robson. As most of the residents would be heading towards Castlegar during the morning rush hour and returning during evening rush hour, these residents would find themselves having to cross the project-related traffic flow to and from the site.

The increase in traffic volumes would also have an impact upon the Robson- Castlegar ferry. Preliminary calculations show that the potential exists for the increase in ferry patronage to exceed the capacity of the ferry, which is currently 28 small cars per trip or 168 per hour. This would lead to traffic delays at both ends of the crossing. Further study would have to be conducted to determine the potential impact of project-related traffic on ferry service, and provide appropriate mitigation measures.

3.2 Temporary or Short Term Conditions (cont'd)

3.2.5 Intermittent Closure of the Robson-Broadwater Highway

Due to the addition of the powerplant to the north end of the dam, approximately 1200 m of the Robson-Broadwater Highway would have to be realigned, periodically closing the Highway to through traffic. B.C. Hydro is considering providing a subgrade road bypassing the construction to ensure continual access. There would also be a road across the cofferdam so that residents along the reservoir would always have at least one access route.

The intermittent closure of the Robson-Broadwater Highway should have no impact on present planning policies, and would not require any change to existing policies.

IMPACTS INCREMENTAL TO THOSE OF THE MURPHY CREEK PROJECT SECTION 4

From a land use perspective, the Keenleyside Powerplant Project would compound two of the impacts associated with the Murphy Creek Project - housing demand, and an increase in auto and truck traffic volumes in the study area.

4.1 Housing Demand

The Keenleyside Powerplant Project would contribute little to increased housing demands associated with the Murphy Creek Project; the demand for temporary employee housing is expected to increase by 30 units, and permanent employee housing by 6 units. Neither of these incremental impacts is considered significant enough to modify the conclusions and the recommendations of the Murphy Creek Project. Assuming the housing market conditions found in 1982 continue (a 10% rental accommodation vacancy rate[3]), the existing housing market, in combination with infilling in existing developed areas, should be sufficient to meet the anticipated housing demand.

4.2 Increase in Auto and Truck Traffic Volumes

Due to the different locations and timing of the Keenleyside and Murphy Creek components of the Keenleyside-Murphy Creek Project, it is probable that the two components would have a minimal impact upon each other. The two areas where the two traffic corridors may overlap would be in Castlegar and on the major highways into the region. However, the overall increase as a result of these projects should have minimal impacts on existing land uses.

CONCLUSIONS AND RECOMMENDATIONS — SECTION 5

Section 5 is composed of two subsections. The first summarizes the impact of the conditions associated with Keenleyside Powerplant Project on existing and potential land uses, planning policies, and the overall impact of the Keenleyside-Murphy Project. The second subsection presents the recommendations for mitigation of the land use impacts, and is a compilation of recommendations made previously in the report.

5.1 Conclusions

This subsection is composed of four parts:

i) Land Use Impacts
ii) Incremental Impact on Murphy Creek Project
iii) Impact on Planning Policy
iv) Impacts and Recommendations Summary Table

5.1.1 Land Use Impacts

Based on the foregoing analysis, the conditions associated with the Keenleyside Powerplant Project which have a significant impact from a land use perspective are temporary or short term in duration. None of the permanent or long term conditions discussed in this report would have a significant impact on existing, planned, or proposed land uses.

Of the temporary or short term conditions, only two would have any significant impact on the study area - increased auto and heavy truck traffic volumes, and temporary employee housing. The increased auto and heavy truck volumes would probably be concentrated on the Robson-Broadwater Highway due to the location of the work site, construction camp and parking lots at the north end of the dam. This may result in potential conflicts between residents commuting to and from Castlegar who will have to cross the project-related traffic flow. This increase may also be a potential safety hazard to pedestrians and bicyclists who use the road shoulder. The increased volumes would also affect ferry service, possibly increasing patronage beyond ferry capacity.

5.1 Conclusions (cont'd)

5.1.1 Land Use Impacts (cont'd)

A further discussion of the demand for temporary employee housing and an evaluation of the incremental impact on the Murphy Creek Project is presented in 5.1.2.

5.1.2 Incremental Impact on Murphy Creek Project

The incremental impact of the Keenleyside Powerplant Project on the Murphy Creek Project would be slight. The major incremental impact would be in terms of additional temporary employee housing demand. Assuming the housing market conditions from 1982 continue to prevail by the end of the Keenleyside Powerplant Project construction period, the existing housing market, combined with infilling in existing developed areas, should be sufficient to meet the incremental demand. Should demand increase in relation to supply, however, this conclusion will have to be re-examined and a new recommendation derived.

5.1.3 Impact on Planning Policy

From the foregoing analysis, it is evident that the existing land use planning policies and implementation bylaws are adequate to accommodate the land use impacts resulting from the Keenleyside-Murphy Project. An adequate amount of land has been set aside in the policies for future land use development. No modifications to existing policies are necessary.

TABLE 5.1
KEENLEYSIDE POWERPLANT PROJECT
LAND USE STUDY
IMPACT ASSESSMENT AND RECOMMENDATIONS FOR MITIGATION

DURATION	CONDITION	IMPACT	RECOMMENDATIONS FOR MITIGATION	COMMENTS
Temporary or Short Term (cont'd)	-traffic	-potential conflict with local traffic, pedestrians and bicyclists, resulting in possible safety hazards	-undertake more detailed transportation analysis, taking into consideration existing condition and function of Robson-Broadwater Hwy, existing traffic volumes, and projected increases in traffic-type and volume of vehicles	
	Intermittent Closure of Robson-Broadwater Hwy	-some inconvenience along reservoir and in Balfour subdivision and Robson		
	Increased Work-related traffic volumes; autos and heavy trucks	-increase in Ferry patronage	Further study of degree of impact	

TABLE 5.1
KEENLEYSIDE POWERPLANT PROJECT
LAND USE STUDY
IMPACT ASSESSMENT AND RECOMMENDATIONS FOR MITIGATION

DURATION	CONDITION	IMPACT	RECOMMENDATIONS FOR MITIGATION	COMMENTS
Permanent or Long Term	Powerplant and Associated Structures	negligible	none required	
	Robson-Broadwater Highway Realignment	negligible	none required	Time differences between alignments will be unnoticable
	Permanent Employee Housing	minimal (small increase in demand on supply of housing)	none required	The recommendations for Murphy Creek housing apply here as condition will be affected by temporary housing demand
	Increased Traffic Volume and Heavy Truck Traffic	minimal (minor increase in volumes and ferry) traffic	none required	The recommendations for "temporary traffic volume increases & heavy truck traffic" will reflect upon permanent traffic volume increases
	Changes in Topography	minimal, assuming reclamation programme	additional mitigation not required	Present B.C. Hydro policy is to reclaim borrow pits

TABLE 5.1
KEENLEYSIDE POWERPLANT PROJECT
LAND USE STUDY
IMPACT ASSESSMENT AND RECOMMENDATIONS FOR MITIGATION

DURATION	CONDITION	IMPACT	RECOMMENDATIONS FOR MITIGATION	COMMENTS
Temporary or Short Term	Temporary Employee Housing	Demand on housing supply of about 30 units	None necessary	Absorbed by the existing housing market, assuming 1982 housing market conditions continue
	Construction of Powerplant and Associated Structures	one house	Add a buffer between house and site	Only one house is within 1.5 km of the site. This house will be subjected to noise, dust and possibly vibration
		BC Timber log sorting site	purchase or land exchange	
	Associated Construction camp impacts: -noise, activity	-disturb other residents	add a buffer zone around camp	Accommodation for up to 320 employees; approx. 60% of maximum workforce
	-traffic	-increase in volumes along Robson - Broadwater Highway and Arrow Lakes Drive and higher ferry patronage	consider: car pooling, staggered shifts, parking lots on south end of dam, further study of impact of traffic volumes on Robson-Broadwater Highway, and on ferry service	Increase in direct proportion to number of trips per person. Existing traffic volumes information is inadequate

5.2 Recommendations

5.2.1 Permanent or Long Term Conditions

1. Provide for appropriate reclamation of all borrow pits.

5.2.2 Temporary or Short Term Conditions

1. Schedule construction activity to minimize closure of the Robson-Broadwater Highway during highway realignment.

2. Provide a haul road so that heavy truck traffic from the borrow pit beside Lower Arrow Lake does not restrict or hinder access to properties and public facilities further along the reservoir.

3. Design the camp so that it will be sited in a manner to minimize potential noise conflicts with surrounding land uses. Provision of a buffer surrounding the camp is one potential method of reducing any impacts.

4. Instigate programmes and strategies designed at reducing traffic volumes on Robson-Broadwater Highway. Such programmes and strategies could include: car pooling, staggered work hours, and parking lots at south end of dam.

5. Undertake a more detailed transportation analysis, taking into consideration the existing condition and function of Robson-Broadwater Highway, existing traffic volumes and projected increase in traffic-type and volume of vehicles. The analysis would also examine the impact of increased traffic volumes on the Robson-Castlegar ferry service, and necessary mitigation measures.

REFERENCES

1. B.C. Hydro (November, 1982) Columbia River Keenleyside Powerplant Project - Engineering Description; Report No. H 1560, Hydroelectric Generation Projects Division. Vancouver, B.C.

2. City of Castlegar (Update 1981) City of Castlegar Zoning Bylaw. Castlegar, B.C.

3. DPA Consulting Limited (June, 1982) Socioeconomic Assessment, Keenleyside-Murphy Project, On Contract to B.C. Hydro Vancouver, B.C.

4. Kerr Wood Leidal Associates (February 1981) Impact on the Murphy Creek Hydroelectric Dam on Municipal Services in the Castlegar Region, Phase I Study; On Contract to B.C. Hydro. Vancouver, B.C.

5. Regional District of Central Kootenay (January 1980) Arrow lakes Regional Plan - Community Land Use and Regional Resource Profiles; Technical Paper No. 6. Nelson, B.C.

6. Regional District of Central Kootenay (May 1981) Castlegar Fringe Settlement Plan - Background Planning Study. Nelson, B.C.

7. Regional District of Central Kootenay (October 1981) Lower Arrow Lake Regional Plan. Nelson, B.C.

8. Regional District of Central Kootenay (Update 1981) Bylaw No. 97 and Amendment Bylaws. Nelson, B.C.

9. Regional District of Central Kootenay (April 1982) Castlegar Fringe Official Settlement Plan; Electoral Areas I and J. Nelson, B.C.

10. Urban Systems Ltd. (November 1981) Murphy Creek Hydroelectric Development Land Use Study - Final Draft Report. On Contract to B.C. Hydro. Kamloops, B.C.

11. William Graham Consultants (February 1981) City of Castlegar Official Settlement Plan. On Contract to City of Castlegar.

APPENDIX A

TERMS OF REFERENCE

3 February 1982

KEENLEYSIDE POWER GENERATION

Terms of Reference
ENVIRONMENTAL STUDIES

1.0 INTRODUCTION

Prior to signing the Columbia Treaty in 1961 and its ratification in 1964, numerous studies were made of the hydroelectric development of the Columbia River in Canada. The Treaty between the United States and Canada led to the construction of Mica and Hugh Keenleyside projects on the Columbia River in Canada. The Revelstoke project on the Columbia, now under construction, is not a Treaty project.

Keenleyside dam was constructed at the outlet of Lower Arrow Lake near Castlegar, above the confluence of the Kootenay River. The project, completed in 1968, was for the purpose of water storage and contained no power generation facilities.

Since 1977, B.C. Hydro has been studying the Murphy Creek project, which would be located on the Columbia River, 35 km downstream of Keenleyside dam. Three reservoir elevations were studied; the lowest level (424 m) would allow the installation of a powerhouse at Keenleyside. The Murphy Creek project, if built, would not be a Treaty project.

Environmental information on the proposed Murphy Reservoir has been collected for levels 430 m, 427 m and 424 m. These terms of reference are for detailed environmental studies of the addition of Keenleyside power generation to the Murphy Creek 424 m case. All environmental studies should assume Murphy 424 m and identify any changes or

incremental impacts caused by the Keenleyside project. All discussions should clearly specify the differences between the two scenarios.

The Keenleyside reports are intended to be read in conjunction with the Murphy Creek documents, and therefore should avoid duplication of baseline data wherever possible.

Information on the study area without further hydroelectric development, and on the impacts of Murphy 424 m, is available in existing Murphy Creek environmental reports.

Study objectives, organization, liaison and methodology are the same as described in the Murphy Creek terms of reference.

B.C. Hydro will supply information on project description and schedules, operating regime, and will make available environmental reports on Murphy Creek.

2.0 STUDY AREA

The study area consists of all lands and waters below 500 m elevation within 10 km of Keenleyside dam. The study area for fisheries should include the lower Arrow Reservoir and the future Murphy Creek Reservoir (or the Columbia River as far south as Trail). The study area for socio-economics and resource evaluation should include local communities of the Columbia Valley.

(a) Reporting Procedures

Written reports will be required for all sections of the studies. Five draft reports and 45 final reports will be required. Draft reports will be prepared and submitted for review by B.C. Hydro and, where necessary, by outside experts before they are accepted. All final reports shall be in a form suitable for release to government agencies and the public. Following completion of all

the reports for the sections, B.C. Hydro will prepare an integrated summary report in consultation with the authors of the sections and outside experts, where necessary.

(b) Studies Schedule

The studies will be undertaken in early 1982. A target schedule showing specific deadlines will be issued for each section.

(c) Studies Sections

The following are guidelines for each of the sections. These guidelines distinguish between inventory and assessment work. Where feasible this distinction should be made in report preparation.

Study sections are:

A Aquatic Resources
B Vegetation, Agriculture and Forestry
C Wildlife
D Heritage Resources
E Socio-economic Resources
F Recreation
G Land Use
H Water Use
I Resource Atlas
J Resource Evaluation

SECTION G - LAND USE

1.0 OBJECTIVES

1. To extend the Murphy Creek Resource Atlas to cover areas potentially affected by the Keenleyside Generation Project.

2. To identify potential impacts of Keenleyside power development on land use planning in the vicinity.

2.0 METHODOLOGY

(a) Inventory

Using the same symbols and format as the Murphy Creek Resource Atlas, map land use information within the study area.

(b) Assessment

1. Discuss the effects, if any, of Keenleyside construction and operation on present and planned use of land (including zoning, policies, development schedules, etc.) in the study area.

2. Comment on the adequacy of present plans to accommodate conditions brought about by the Keenleyside generation project.

POOR

QUALITY

ORIGINAL